

**Fermilab  
FY2006 Self-assessment  
Process Assessment Report  
For  
Technical Division**

**17-Feb-2006**

Division/Section performing assessment

Technical Division

Name of organization that owns assessed process

Technical Division

Organization Strategy

The Technical Division provides design and fabrication services to the Lab and the HEP field as a whole. Ensuring that gages used to measure product quality are adequately calibrated is part of the division's quality program.

Names of Personnel on Assessment team

Jamie Blowers, Ted Beale

Name of process assessed

Calibration program

Brief description of process to be assessed

We reviewed the calibration program within the Technical Division. The scope was the industrial areas and the Village Machine Shop (e.g. we did not include the satellite shops).

1. Are metrics associated with this process? If so, what are they?

There are no contractual metrics.

2. What are the names of the procedures associated with this process?

1. TD Quality Management Program (TD-2010)
2. Test & Instrumentation Department Calibration Program (PROC-03-001)

3. Are these procedures being followed? Are they current?

Overall the procedures are being followed, and they are current. The T&I document is current, but it is currently not implemented.

4. Describe the methodology used to assess this process.

This assessment followed standard audit practices. A checklist was created prior to the audit, and it was forwarded to the auditee. Interviews were conducted using the checklist to frame the conversations. The checklist was used to record the details from the interviews. We also conducted a follow-up meetings to discuss possible actions as a result of the assessment.

5. Results of the assessment:

The results of this assessment are overall acceptable. In most areas the gages used to measure product quality are under calibration. The gages are well marked, and a system is in place to identify the gages due for calibration. Within the last five years the Division migrated most of its calibration tracking to a third-party system, and this was a very good decision. The only area where this is not used is in the Test & Instrumentation Department, where they have unique needs which make it difficult to adopt a third-party system.

There are two areas where major findings were identified. One is in the Test & Instrumentation Department, where calibration is not currently being done. The T&I leadership have a very sound plan in place, but lack the resources to fulfill the plan. A subsequent meeting with the Division Head resulted in a statement of support from Headquarters for implementing the calibration program. The second major finding is in the Village Machine Shop. It was confirmed that many machinists use there personal gages for performing their QC checks. For parts which later are inspected in the IB4 QC lab, this is not a problem. However, a large fraction of the parts go directly to the customer, and in these cased the machinists are performing the final QC check.

#### Identified opportunities for improvement

1. PROC-03-001 lists six pieces of equipment which are used to perform calibrations. This equipment needs to be calibrated as stated in the procedure (T&I).
2. Include resource requirements in the annual budget request process to ensure that resources are available to perform the calibrations as described in PROC-03-001 (T&I).
3. Make the necessary changes to the T&I instrument database so that calibration due dates are identified (T&I).
4. Review the calibration requirements for the hydro flow carts (MSD).
5. Review the calibration records for electrical equipment and the calibration database to make sure that they are consistent (MSD).
6. Label "reference only" gages as such (MSD).
7. The use of personal gauges and their calibration needs to be reviewed and modified to meet the division's policy (MS).
8. The gauges which are identified as overdue should be located or flagged in the database as missing (MS).
9. Review the frequency of calibration of the MS CMM, granite plates, and standards in the tool crib (MS)

#### Schedule for implementation of improvements

1. Completed by the end of FY06.
2. Completed by the end of FY06.
3. Completed by the end of CY06.
4. Completed by the end of CY06.
5. Completed by the end of FY06.
6. Completed by the end of CY06.
7. Completed by the end of CY06.
8. Completed by the end of FY06.
9. Completed by the end of FY06.

#### Status of improvements from previous assessment

N/A

#### Attachments (supporting data, worksheets, reports, etc.)

1. Audit checklists.
2. Excerpts from TD-2010.
3. T&I Procedure PROC-03-001.
4. Calibration reports of past-due gages.

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB4*

<i>Reference</i>	<i>Criteria</i>	<i>Results</i>			<i>Comments</i>
		<i>Fully Sat</i>	<i>Minor Issue</i>	<i>Major Issue</i>	
TD-2010 section 8.5	All equipment which effects product quality (or is used to make a decision which effects product quality) is calibrated at prescribed intervals.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>All equipment used for incoming inspection is calibrated at regular intervals. Intervals were determined by personnel no longer working in the QC lab, but principally were determined by frequency of equipment use. Records for all calibrations are available.</p> <p>Equipment that is used as “reference only” is identified as such. There does not appear to be any use of personal gauges in the QC lab.</p>
TD-2010 section 8.5	Equipment is appropriately identified with its calibration status.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All equipment reviewed had stickers which identified the last calibration date, the initials of the person who conducted the calibration, and the calibration due date.
TD-2010 section 8.5	Calibration reference standards are traceable to a nationally recognized organization (e.g. NIST); otherwise the basis used for calibration is appropriately documented.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The QC lab performs calibrations on the division’s mechanical gauges. This is done using standards which are traceable to NIST. Records of the calibrations are provided to the gauge custodians, and the calibration work is entered into the division’s calibration database.
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Questions to ask and answer:

- How is it decided which equipment is to be calibrated?
- Is there equipment used to inspect or test which is not or can not be calibrated?
- How is the calibration frequency determined?
- How is the reference standard determined?
- Are records of each calibration maintained?
- Is each piece of equipment appropriately identified with its calibration status?

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB4*

- If software is used with the equipment, how is that considered when doing calibration?
- What is done when a piece of equipment is found to be out of calibration?
- How is the equipment safeguarded against adjustments, damage, or deterioration between calibration intervals?
- Do the users of the equipment understand their part in the calibration program (e.g. do they verify calibration status prior to use; do they know what to do if they find a gauge out of calibration)?

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB2*

<i>Reference</i>	<i>Criteria</i>	<i>Results</i>			<i>Comments</i>
		<i>Fully Sat</i>	<i>Minor Issue</i>	<i>Major Issue</i>	
TD-2010 section 8.5	All equipment which effects product quality (or is used to make a decision which effects product quality) is calibrated at prescribed intervals.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>Persons responsible for measurement and testing product quality have a thorough understanding of the requirements and, with one exception, use only calibrated equipment for such measurements.</p> <p><b>Action: review the calibration requirements for the hydro flow carts.</b></p>
TD-2010 section 8.5	Equipment is appropriately identified with its calibration status.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>A Calibration Due Listing indicates that 22 items are past due for calibration. An audit of a subset of these items indicates that some of the items were calibrated although the database didn't have the recent calibrations recorded. It is also believed that several of the 22 items should have their status changed to "For Reference Only". The list is attached as an action item.</p> <p><b>Action: review the calibration records for electrical equipment and the calibration database to make sure that they are consistent.</b></p> <p><b>Action: label "reference only" gages as such.</b></p>
TD-2010 section 8.5	Calibration reference standards are traceable to a nationally recognized organization (e.g. NIST); otherwise the basis used for calibration is appropriately documented.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>The only calibration to be performed in-house on IB2 gages is for the hydro flow carts. The first action item above will include documenting the standard for calibration.</p>

Questions to ask and answer:

- How is it decided which equipment is to be calibrated?
- Is there equipment used to inspect or test which is not or can not be calibrated?
- How is the calibration frequency determined?

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB2*

- How is the reference standard determined?
- Are records of each calibration maintained?
- Is each piece of equipment appropriately identified with its calibration status?
- If software is used with the equipment, how is that considered when doing calibration?
- What is done when a piece of equipment is found to be out of calibration?
- How is the equipment safeguarded against adjustments, damage, or deterioration between calibration intervals?
- Do the users of the equipment understand their part in the calibration program (e.g. do they verify calibration status prior to use; do they know what to do if they find a gauge out of calibration)?

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB1*

<i>Reference</i>	<i>Criteria</i>	<i>Results</i>			<i>Comments</i>
		<i>Fully Sat</i>	<i>Minor Issue</i>	<i>Major Issue</i>	
TD-2010 section 8.5	All equipment which effects product quality (or is used to make a decision which effects product quality) is calibrated at prescribed intervals.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>T&amp;I has a very well documented calibration program (PROC-03-001). This program, however, is not implemented at this time. For the most part systems are in place to be able to do the calibrations, but resources are currently not available.</p> <p>Calibration frequency, as described in the plan PROC-03-001) are based on instrument stability, required tolerances, and manufacturer's recommendations.</p> <p>It was noted that the ICB Engineering Lab calibrates the Cernox temperature sensors. A visit to the Lab, and conversation with the previous Lab lead person, resulted in confirmation that the instruments which effect Cernox calibration data are presently under calibration.</p> <p><b>Action: PROC-03-001 lists six pieces of equipment which are used to perform calibrations. This equipment needs to be calibrated as stated in the procedure.</b></p> <p><b>Action: Include resource requirements in the annual budget request process to ensure that resources are available to perform the calibrations as described in PROC-03-001.</b></p>
TD-2010 section 8.5	Equipment is appropriately identified with its calibration status.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>Equipment reviewed has calibration labels, but they were all out of date. The in-house database also records calibration status, but does not include the calibration due date.</p>



## TD-2006-01 Technical Division Calibration Program - Audit Checklist for *IB1*

<i>Reference</i>	<i>Criteria</i>	<i>Results</i>			<i>Comments</i>
		<i>Fully Sat</i>	<i>Minor Issue</i>	<i>Major Issue</i>	
					<b>Action: make the necessary changes to the instrument database so that calibration due dates are identified.</b>
TD-2010 section 8.5	Calibration reference standards are traceable to a nationally recognized organization (e.g. NIST); otherwise the basis used for calibration is appropriately documented.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Since no gages have been calibrated in years, there currently is no traceability to national standards.
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Questions to ask and answer:

- How is it decided which equipment is to be calibrated?
- Is there equipment used to inspect or test which is not or can not be calibrated?
- How is the calibration frequency determined?
- How is the reference standard determined?
- Are records of each calibration maintained?
- Is each piece of equipment appropriately identified with its calibration status?
- If software is used with the equipment, how is that considered when doing calibration?
- What is done when a piece of equipment is found to be out of calibration?
- How is the equipment safeguarded against adjustments, damage, or deterioration between calibration intervals?
- Do the users of the equipment understand their part in the calibration program (e.g. do they verify calibration status prior to use; do they know what to do if they find a gauge out of calibration)?

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for VMS

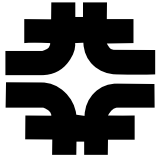
Reference	Criteria	Results			Comments
		Fully Sat	Minor Issue	Major Issue	
TD-2010 section 8.5	All equipment which effects product quality (or is used to make a decision which effects product quality) is calibrated at prescribed intervals.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>The gauges owned by the division machine shop are in the calibration database, and are calibrated at prescribed intervals by the TD QC lab. In addition, the CMM and granite plates are also calibrated (<i>recommend that the frequency of these calibrations be reviewed</i>). Records of the CMM calibration were reported to be available, but this was not confirmed.</p> <p>Personal gauges are not part of the calibration program. The machinists interviewed stated that they primarily use their personal gauges to inspect their work, and would only use the Lab gauges if their gauges were not of the necessary size. They also reported that they would regularly check their gauges against the standards which come with the gauges, but these checks are not documented.</p> <p><b>Action: The use of personal gauges and their calibration needs to be reviewed and modified to meet the division's policy.</b></p> <p><b>Action: The gauges which are identified as overdue should be located or flagged in the database as missing.</b></p>
TD-2010 section 8.5	Equipment is appropriately identified with its calibration status.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Numerous gauges in the tool crib we looked at and all but two were properly identified as to their calibration status. A subsequent check in the database showed that one was in calibration but not labeled, and the other was out of service (the Machine Shop is in the process of reviewing gauges and identifying ones which can be taken out of</p>

## TD-2006-01 Technical Division Calibration Program - Audit Checklist for VMS

<i>Reference</i>	<i>Criteria</i>	<i>Results</i>			<i>Comments</i>
		<i>Fully Sat</i>	<i>Minor Issue</i>	<i>Major Issue</i>	
					service).
TD-2010 section 8.5	Calibration reference standards are traceable to a nationally recognized organization (e.g. NIST); otherwise the basis used for calibration is appropriately documented.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The Machine Shop does not perform any calibrations, but they do maintain a small number of reference standards. Some are sent through the QC lab for verification, and others have not been ( <i>recommend sending all standards through QC at least once to verify that they are still OK</i> ).
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Questions to ask and answer:

- How is it decided which equipment is to be calibrated?
- Is there equipment used to inspect or test which is not or can not be calibrated?
- How is the calibration frequency determined?
- How is the reference standard determined?
- Are records of each calibration maintained?
- Is each piece of equipment appropriately identified with its calibration status?
- If software is used with the equipment, how is that considered when doing calibration?
- What is done when a piece of equipment is found to be out of calibration?
- How is the equipment safeguarded against adjustments, damage, or deterioration between calibration intervals?
- Do the users of the equipment understand their part in the calibration program (e.g. do they verify calibration status prior to use; do they know what to do if they find a gauge out of calibration)?



While travelers are used for all major production runs, and most "onesy-twosy" repairs, travelers may not be used in all situations. In the event that travelers are not used, it is still a requirement to develop adequate inspection and testing methods and to maintain records of all inspection and testing.

It should be noted that "final" inspection might also include performance measurements, such as taking magnet measurements at the Measurement and Test Facility of the Development and Test department or detector component measurements on a cosmic ray stand. The Project Manager is responsible for deciding when performance measurements are necessary. When performance measurements are required, the testing requirements must be appropriately defined, documented, and communicated to measurement personnel. Testing results must be appropriately documented and communicated back to the customer.

## **8.5 Measuring and Test Equipment Calibration**

Calibration in the Technical Division can occur in two ways:

1. Equipment is tested with a reference, and the equipment settings may be adjusted to match the standard. After the calibration the equipment has a known accuracy.
2. Equipment is tested with a reference, and the equipment cannot be adjusted to match the reference. In this case, the calibration results are used to adjust the raw data from the equipment when it is used to measure product.

All equipment which effects product quality (or is used to make a decision which effects product quality) is calibrated at prescribed intervals, and is appropriately identified with its calibration status. In general, calibration reference standards are traceable to NIST or other national/international organizations. If no national standard exists, then the basis used for calibration is appropriately documented.

Department Heads are responsible for analyzing their work process measuring and test equipment to determine the appropriate calibration requirements. Department Heads are also responsible for developing an effective program for the necessary calibration activities.

The Material Control department provides calibration services for the calibration of mechanical instruments and equipment used by the division. And although Material Control performs the calibration service, and may recommend the frequency with which equipment should be inspected and recalibrated, the Department Head whose organization owns the equipment is responsible for ensuring the equipment is properly maintained and calibrated.



**FERMILAB**  
**Technical Division**

**T & I**  
**CALIBRATION REQUIREMENTS**  
**STANDARD**

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## 1. Purpose

The purpose of this document is to define the T&I calibration requirements standard and to provide a plan for calibrating measurement and control instrumentation in the T&I Department.

## 2. Scope

This standard provides for the establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment used to assure that calibration services provided by the T&I Department for acceptance are in conformance with prescribed technical requirements. This T&I standard has been derived from the *Technical Division SQIP* and the *Military Standard for Calibration Requirements MIL-STD-45662*.

## 3. Introduction

The mission of the Magnet Test Facility (MTF) is to provide precision measurements of magnetic fields and other parameters such as quench performance for Fermilab and other laboratories' accelerator magnets. In order to insure that accurate measurements are made it is necessary to maintain properly calibrated instruments. This includes all measurement instruments and controls installed on the test stands that are either used to control the measurement process or record physical data. Standard engineering practices are used for calibrating this equipment and storing the calibration data. For the conventional measurements system, a database is employed in which calibration data for all instruments in use at each test stand is maintained; the data acquisition programs read these calibration data whenever a magnet measurement is performed. Instrument and sensor calibrations associated with the cryogenic test stands are stored in the T&I database, in special calibration files, or burned into onboard non-volatile ram of some instruments. For example, sensors such as pressure transmitters and in-house instruments such as programmable isolation amplifiers have their calibrations stored in the T&I database.

## 4. Applicability

This standard applies to all systems and equipment, which the T&I Department is required to maintain, for measurements and tests in support of Magnet & SRF Test Operations. The quality of the measurement results "deliverables" ultimately depends on the accuracy of the process variables implemented. The accuracy of the process variables, however, is dependant on the accuracy of the instruments and sensors performing the measurement, which is subject to some deviation dependent on their calibration maintenance program. Therefore the standard applies to all measurement and test equipment that affects the accuracy of the process variables. The following is a table of process variables used for making measurements:



**T&I**  
**Calibration Requirements Standard**

*Process Variables used in MTF*

#	Process Variable
1	Pressure
2	Temperature
3	Flow
4	Strain (capacitive, resistive)
5	Liquid Level
6	Current
7	Idot
8	Voltage
9	Frequency
10	Magnetic Field Strength
11	RF Field Strength
12	Vibration
13	Position (encoder)

Table 1

## 5. Definitions

- 5.1. Calibration. Comparison of a measurement standard or instrument of known accuracy with another standard or instrument to detect, correlate, report, or eliminate by adjustment, any variation in the accuracy of the item being compared.
- 5.2. Measuring and test equipment. All devices used to measure, gage, test, inspect, or otherwise examine items to determine compliance with specifications.
- 5.3. Measurement standard (reference). Standards of the highest accuracy order in a calibration system, which establish the basic accuracy values for that system.
- 5.4. A Measurement standard (transfer). Designated measuring equipment used in a calibration system as a medium for transferring the basic value of reference standards to lower echelon transfer standards or measuring and test equipment.
- 5.5. Tractability. The ability to relate individual measurement results to national standards or nationally accepted measurement systems through an unbroken chain of comparisons.

## 6. General Statements of Requirements

The T&I Department shall establish or adapt and maintain a system for the calibration of all measuring equipment used in fulfillment of the Magnet Test Operations requirements. The calibration system shall be coordinated with the Inspection or Quality Control Systems and shall be designed to provide adequate accuracy in use of measuring and test equipment. The calibration system shall provide for the prevention of inaccuracy by ready detection of deficiencies and finding positive action for their correction. The T&I





Department shall make objective evidence of accuracy conformance readily available to the Operations group personnel.

## 7. Detailed Statements of Requirements

- 7.1. Calibration system description. The T&I Department shall provide and maintain a written description of its calibration system covering measuring and test equipment and measurement standards to satisfy each requirement of this standard. The portion dealing with measuring and test equipment shall prescribe calibration intervals and sources and may be maintained on the documents normally used by the Operations group to define inspection protocol. The description for calibration of measurement standards shall include a listing of the applicable measurement standards, both reference and transfer, and shall provide nomenclature, identification member, calibration interval and source, and environmental conditions under which the measurement standards will be applied and calibrated. The description of the calibration system and applicable procedures and reports of calibration shall be available to the Operations personnel.
- 7.2. Adequacy of standards. Standards established by the T&I Department for calibrating the measuring and test equipment used in controlling product quality should have the capabilities for accuracy, stability, range, and resolution required for the intended use.
- 7.3. Environmental controls. Measuring and test equipment and measurement standards shall be calibrated and utilized in an environment controlled to the extent necessary to assure continued measurements of required accuracy giving due consideration to temperature, humidity, vibration, cleanliness, and other controllable factors affecting precision measurement. When applicable, compensating corrections shall be applied to calibration results obtained in an environment, which departs from standard conditions.
- 7.4. Intervals of calibration. Measuring and test equipment and measurement standards shall be calibrated at periodic intervals established on the basis of stability, purpose, and degree of usage. Intervals shall be shortened as required to assure continued accuracy as evidenced by the results of preceding calibrations and may be lengthened only when the results of previous calibrations provide definite indications that such action will not adversely affect the accuracy of the system. The T&I Department shall establish a recall system for the mandatory recall of standards and measuring and test equipment within established time limits or interval frequencies.
- 7.5. Calibration procedures. Written procedures shall be prepared or provided and utilized for calibration of all measuring and test equipment and measurement standards used to assure the accuracy of measurements involved in establishing product conformance. The procedures may be a compilation of published standard practices or manufacturer's written instructions and need not be rewritten to satisfy the requirements of this standard. As a minimum, the



procedures shall specify the accuracy of the instrument being calibrated and the accuracy of the standards used. *The procedure shall require that calibration be performed by comparison with higher accuracy level standards.*

- 7.6. Evaluation of calibration system accuracy. The T&I Department shall establish a procedure to evaluate the adequacy of the calibration system based on the out of tolerance data generated from calibrating test and measurement equipment. The procedure shall include but not be limited to adjustment of calibration frequency, adequacy of the measuring or test instrument, calibration procedures and measuring or test procedures. The procedures shall specifically provide for the identification and prevention of use of any equipment that does not perform satisfactorily.

## 8. Calibration sources

- 8.1. Commercial calibration of sources. Measuring and test equipment shall be calibrated by the T&I Department or a commercial facility utilizing standards whose calibration is certified as being traceable to the National Standards, has been derived from accepted values of natural physical constants, or has been derived by the ratio type of self-calibration techniques. Standards requiring calibration by a higher-level standards laboratory shall be calibrated by a commercial facility capable of providing the required service, or data sheets attesting to the date, accuracy, and environmental or other conditions, under which the results furnished were obtained, shall support all standards used in the calibration system. Statements of certification shall be traceable to NIST. All subordinate standards and measuring and test equipment shall be supported by like data when such information is essential to achieving the accuracy control required by this standard. In those cases where no data is required, a suitably annotated calibration label on the item shall be sufficient to satisfy the support data requirements. Certificates or reports from other than the National Institute of Standards and Technology shall attest to the fact that the standards used in obtaining the results have been compared at planned intervals with the National Standard either directly or through a controlled system utilizing the methods outlined above. The commercial facility shall be responsible for assuring that the sources providing calibration services, other than the National Institute of Standards and Technology are in fact capable of performing the required service to the satisfaction of this standard. All certificates and reports shall be available for inspection by Operations group personnel.

- 8.2. Application of records. Records designed to assure that established schedules and procedures are followed to maintain the accuracy of all measuring and test equipment, and supporting standards, will support the application of the above requirements. These records shall include an individual record of calibration or other means of control for each item of measuring and test equipment and measurement standards, providing description or identification of the item, calibration interval, date of last calibration, and calibration results of out of tolerance conditions. In addition, the individual record of any item whose



accuracy must be reported via a calibration report or certificate will quote the report or certificate number for ready reference. These records shall be available for review by Operations personnel.

- 8.3. Calibration status. Measuring and test equipment and standards shall be labeled or some other suitable means shall be established for monitoring the equipment to assure adherence to calibration schedules. The system shall indicate date of last calibration, by whom calibrated and when the next calibration is due. The system may be automated or manual. Items that are not calibrated to their full capability or require functional check only shall be labeled to indicate the applicable condition.
- 8.4. Control of commercial calibration. The T&I Department is responsible for assuring that the calibration system of a commercial vendor conforms to this standard to the degree necessary to assure compliance with Operations requirements.
- 8.5. Storage and handling. All measuring and test equipment shall be handled, stored, and transported in a manner that shall not adversely affect the calibration or condition of the equipment.

## 9. General T&I Calibration Procedure

- 9.1. Calibration of standards. The calibration standards will be color coded and tagged with the date it is due for calibration. When the calibration is due, it will be sent out to the manufacturer or to a capable commercial vendor to be calibrated. When it is returned a "Certificate of Calibration" traceable to NIST must accompany the standard.
- 9.2. Calibration of instrumentation and controls. All calibration of instrumentation and controls will be maintained and the due date and period of calibration will be recorded in the T&I database. All equipment will be bar coded in order to provide a searchable means for tracking the calibration history.
- 9.3. Instrumentation and controls out of calibration. If an instrument or control device is out of calibration it must be tagged as so in the database. When possible the device is recalibrated in-house against a calibration standard. If the instrument cannot be calibrated in-house, it must be sent to the manufacturer or a capable commercial vendor to be calibrated. When it is returned a "Certificate of Calibration" traceable to NIST must accompany the standard.
- 9.4. Replacement of instrumentation and controls. If an instrument or control device cannot be maintained within the calibration specifications it must be replaced. A "Certificate of Calibration" traceable to NIST must accompany all new instrumentation and controls.



## 10. Specific T&I Calibration Procedures

All instrumentation and control device calibration procedures will be listed on the T&I shared drive. These procedures will also be accessible on the web.

## 11. Specific T&I Calibration Intervals

All instrumentation and control devices will be calibrated at specific intervals, which are determined by the measurement system requirements of the Operations group. The following table indicates the typical calibration intervals:

*Standard Calibration Intervals*

#	Interval
1	Every use
2	Three (3) month
3	Six (6) month
4	One (1) year
5	Two (2) year
6	Three (3) year
7	Five (5) year
7	Once

Table 1

## 12. T&I Calibration Standards

Most measurement and control instrumentation used in the Magnet Test Facility (MTF) requires a voltage calibration against a voltage standard. However, there are some measurement devices such as pressure transducers and current transducers that require a transfer standard type other than voltage. There are also many temperature sensors in use in the MTF measurement systems, but these sensors are not calibrated by the T&I Department. These sensors are calibrated by the manufacturer, such as Lakeshore Cryotronics, or in-house by the Technical Division Engineering Calibration Lab. These sensor calibrations are all traceable to NIST. The T&I Department maintains the



following measurement transfer standards for performing calibrations of measurement and control instrumentation in the Magnet Test Facility:

*In-House Calibration Standards*

#	Manufacturer / Model	Standard Transfer Type	Calibration Type	Certification Frequency
1	Hewlett Packard 3458A dmm	DC Voltage Measurement	DC Voltage	Annually
2	Fluke 5440B Direct Volts Calibrator	DC Voltage Source	DC Voltage	Annually
3	Scanivalve Corp. 100/200 Pressure Calibrator	Absolute Pressure Meas.	Absolute Pressure	Annually
4	Holec 10Kamp Current Trans.	High Current Measurement	DC Current	Annually
5	MetroLab PT 2025 Digital NMR Teslameter	Magnetic field measurement	Magnetic field	Annually
6	GenRad Inc. 1693 RLC Digibridge <sup>TM</sup>	LCR Bridge Measurement	Inductance & Capacitance	Annually

Table 2

### 13. T&I Measurement & Control Instrumentation

The following table lists the MTF measurement and control instrumentation requiring periodic calibration by the T&I Department:

#	Manufacturer	Description	Calibration Type	Calibration Frequency
1	Sensotec	Absolute pressure transducer	Pressure	Annually
2	Pentec	4275A-007 32-Channel 100kHz 16-Bit A/D (logger)	Voltage	Annually
3	Holec Current Trans.	High Current Measurement	DC Current	Annually
3	FNAL	8-channel programmable gain isolation amplifier.	Voltage	Annually



**T&I**  
**Calibration Requirements Standard**

4	Hewlett Packard	7 1/2 digit Digital Multimeter (DMM)	Voltage	Annually
5	Analogic	DVX-2503 8-channel 16-Bit ADC	Voltage	Annually
6	FNAL	Fiber-Optic Current Transmitter	Voltage	Annually
7	FNAL	Fiber-Optic Current Receiver	Voltage	Annually
8	Metrolab	PDI-5035 Digital Integrator	Voltage	Annually
9	Brooks	Helium Gas Flow meter	Flow	Annually

Table 3



**Fermilab**  
**Technical Division Q.C. Dept.**

**Calibration Due Listing by Storage Location**

From:

To: 2/20/2006

3/20/2006

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Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
IB2	AMD-MI002		Micrometer, Depth 0-4 inch	4/5/2002	2.00 YEARS
IB2	DHCF-3		Indicator, Dial 0-1 inch	4/4/2005	5.00 YEARS
IB2	9170503	9170503	Hypotultra II 12KVDC Tester	4/17/2003	1.00 YEARS
IB2	9170504	9170504	Hypatultra II 12KVDC Tester	5/26/2003	1.00 YEARS
IB2	9170505	9170505	Hypotultra II 12KVDC Tester	5/9/2003	1.00 YEARS
IB2	ACD-MI003		Caliper, Dial 0-12 inch	4/5/2002	2.00 YEARS
IB2	ADG-LS008		Indicator, Dial 0-.025 inch	4/15/2002	2.00 YEARS
IB2	ADG-LS014		Indicator, Dial 0-.030 inch	4/17/2002	2.00 YEARS
IB2	39311	1988	HyPot	7/9/2002	1.00 YEARS
IB2	37500	1973	HyPot	7/9/2002	1.00 YEARS
IB2	3227A12779	3227A12779	Digital Oscilloscope 100 MHz	7/9/2004	1.00 YEARS
IB2	3145J02299	3145J02299	LCR Meter	7/10/2003	1.00 YEARS
IB2	3145J02245	3145J02245	LCR Meter	7/9/2003	1.00 YEARS
IB2	13700/46797	13700/46797	Crane Scale 70Klb.	3/15/2004	1.00 YEARS
IB2	IB4-071		Caliper, Dial	3/23/2001	1.00 YEARS
IB2	39130	2024	AR Analog HiPotter	7/9/2002	1.00 YEARS
IB2	1254	1254	Hipotter 15KVDC	7/10/2003	1.00 YEARS
IB2	3145J02056	3145J02056	LCR Meter	7/9/2003	1.00 YEARS
IB2	BMO-SE001		Micrometer, Outside 0-1 inch	4/12/2002	2.00 YEARS
IB2	BMO-BS004		Micrometer, Outside 3-4 inch	4/14/2003	3.00 YEARS
IB2	APL-LS003		Level, Mechanics	8/9/2002	1.00 YEARS
IB2	AMD-MI004		Micrometer, Depth 0-4 inch	4/5/2002	2.00 YEARS
IB2	3114A13539	3114A13539	7 1/2 Digital Multimeter	12/12/2003	1.00 YEARS
IB2	3114A17771	3114A17771	7 1/2 Digital Multimeter	7/10/2003	1.00 YEARS
IB2	1218980	1218980	30,000 LB. Crane Scale	3/20/2003	1.00 YEARS
IB3	B142196	B142196	350 MHz Oscilloscope	10/23/2003	1.00 YEARS
IB3	804-090		Indicator, Dial 0-.500 inch	3/19/2002	5.00 YEARS
IB3	65577	B032818	Current Probe	7/10/2002	1.00 YEARS
IB3	85798	2929A03821	Digital Oscilloscope 500 MHz	7/10/2002	1.00 YEARS
IB3	804-148		Caliper, Dial	8/15/2005	2.00 YEARS
IB3	804-125		Indicator, Dial 0-.200 inch	3/25/2002	5.00 YEARS
IB3	804-111		Indicator, Dial 0-.500 inch	3/19/2002	5.00 YEARS

Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
IB3	804-097		Indicator, Dial 0-.250 inch	3/19/2002	5.00 YEARS
IB3	804-094		Indicator, Dial 0-1 inch	3/19/2002	5.00 YEARS
IB3	804-091		Indicator, Dial 0-1 inch	3/19/2002	5.00 YEARS
IB3	65538	B0260356	Scope Plug-In 200 MHz	7/10/2002	1.00 YEARS
IB3	2703A07001	2703A07001	7 1/2 Digital Multimeter	7/9/2003	1.00 YEARS
IB3	2703A11366	2703A11366	7 1/2 Digital Multimeter	7/9/2003	1.00 YEARS
IB3	2703A11403	2703A11403	7 1/2 Digital Multimeter	7/10/2003	1.00 YEARS
IB3	2703A11653	2703A11653	7 1/2 Digital Multimeter	7/12/2004	1.00 YEARS
IB3	3114A12085	3114A12085	Digital Multimeter 7 1/2 digit	7/9/2003	1.00 YEARS
IB3	3227A12783	3227A12783	Oscilloscope 100MHz	7/8/2003	1.00 YEARS
IB3	4965-001		Caliper, Digital 0-6 inch	8/9/2002	1.00 YEARS
IB3	4965-002	0058827	Caliper, Digital 0-6 inch	5/10/2004	1.00 YEARS
IB3	804-030		Micrometer, Depth 0-12 inch	3/20/2002	5.00 YEARS
IB3	65529	B125170	Scope Plug-In 1MHz	7/11/2002	1.00 YEARS
IB3	804-089		Indicator, Dial 0-1 inch	3/19/2002	5.00 YEARS
IB3	65541	B133712	Scope Plug-In	7/10/2002	1.00 YEARS
IB3	65542	B065868	Oscilloscope Plug-In	7/10/2002	1.00 YEARS
IB3	804-133		Standard, Depth Micrometer	3/20/2002	5.00 YEARS
IB3	804-023		Height Gage, Vernier 20 inch	3/20/2002	5.00 YEARS
IB3	804-033		Level, Mechanics	2/3/2005	1.00 YEARS
IB3	804-040		Height Gage, Vernier 24 inch	3/19/2002	5.00 YEARS
IB3	804-041		Height Gage, Vernier 24 inch	3/19/2002	5.00 YEARS
IB3	804-043		Height Gage, Vernier 24 inch	3/19/2002	5.00 YEARS
IB3	804-086		Caliper, Vernier 0-7 inch	3/20/2002	5.00 YEARS
IB3	64691	H707287	Oscilloscope MF 100MHz	7/10/2002	1.00 YEARS
IB3	804-117		Indicator, Dial 0-5 inch	10/7/2005	2.00 YEARS
IB4	2181	2181	Balance	6/20/2005	1.00 YEARS
IB4	SC15	5033511-5WZ	Balance	6/20/2005	1.00 YEARS
IB4	TE6	TE6-D87945	Balance	6/20/2005	1.00 YEARS
ICB	JP1KD00184	JP1KD00184	LCR Meter	7/8/2003	1.00 YEARS
ICB	2934A01113	2934A01113	Digital Oscilloscope 400 MHz	7/8/2003	1.00 YEARS
ICB	806-041		Indicator, Dial 0-1 inch	8/9/2004	3.00 YEARS
ICB	806-101		Pi Tape 24-36 inch	8/9/2004	3.00 YEARS
ICB	806-103		Indicator, Dial 0-1 inch	4/4/2005	5.00 YEARS
ICB	none	673	HyPot	7/9/2002	1.00 YEARS
ICB	806-104		Indicator, Dial 0-1 inch	7/26/2004	3.00 YEARS
ICB Eng. Lab	470390	470390	programable current source	7/15/2004	1.00 YEARS



Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
Machine Repair	109-010		Level, Mechanics	8/27/2003	3.00 YEARS
Machine Repair	109-014		Level, Precision	8/27/2003	1.00 YEARS
Machine Repair	109-013		Level, Precision	8/27/2003	1.00 YEARS
Machine Repair	109-012		Level, Precision	12/2/2002	1.00 YEARS
Machine Repair	109-002		Micrometer, Outside 1-2 inch	4/5/1999	1.00 YEARS
Machine Repair	109-011		Square, Cylindrical 12 inch	6/3/2002	3.00 YEARS
Machine Repair	109-007		Standard, Measuring	11/30/2004	3.00 YEARS
Machine Repair	109-009		Standard, Measuring	11/30/2004	3.00 YEARS
Machine Repair	109-008		Indicator, Dial 0-.016 inch	11/30/2004	3.00 YEARS
Machine Repair	109-003		Micrometer, Outside 2-3 inch	4/5/1999	1.00 YEARS
MFMS	IB4-050		Indicator, Dial	3/18/2003	1.00 YEARS
MFMS	IB4-049		Indicator, Dial	3/18/2003	1.00 YEARS
MFMS	IB4-042		Micrometer, Inside	7/11/1997	1.00 YEARS
MFMS	IB4-065		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-052		Height Gage, Dial	3/12/2003	1.00 YEARS
MFMS	IB4-053		Caliper, Vernier	2/15/2002	2.00 YEARS
MFMS	IB4-054		Micrometer, Outside	1/22/2001	1.00 YEARS
MFMS	IB4-048		Indicator, Dial	1/24/2001	1.00 YEARS
MFMS	IB4-064		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-037		Caliper, Dial	3/12/2003	1.00 YEARS
MFMS	IB4-070		Square, Precision	2/7/2001	1.00 YEARS
MFMS	IB4-069		Gage, Bore	7/11/1997	1.00 YEARS
MFMS	IB4-068		Micrometer, Outside	7/10/1997	1.00 YEARS
MFMS	IB4-067		Caliper, Dial	7/10/1997	1.00 YEARS
MFMS	IB4-063		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-057		Micrometer, Outside	1/22/2001	1.00 YEARS
MFMS	IB4-055		Micrometer, Outside	1/22/2001	1.00 YEARS
MFMS	IB4-047		Micrometer, Outside	2/15/2001	1.00 YEARS
MFMS	IB4-062		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-061		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-060		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-058		Micrometer, Outside	1/22/2001	1.00 YEARS
MFMS	IB4-056		Micrometer, Outside	1/22/2001	1.00 YEARS
MFMS	IB4-066		Square, Precision	4/6/2001	3.00 YEARS
MFMS	IB4-024		Micrometer, Inside	2/9/2001	1.00 YEARS
MFMS	IB4-014		Micrometer, Outside Blade	3/20/2003	1.00 YEARS
MFMS	IB4-015		Micrometer, Outside Blade	3/20/2003	1.00 YEARS

Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
MFMS	IB4-016		Micrometer, Outside Disc Anvil	3/20/2003	1.00 YEARS
MFMS	IB4-017		Micrometer, Outside Disc Anvil	3/20/2003	1.00 YEARS
MFMS	IB4-018		Micrometer, Outside V-Anvil	3/20/2003	1.00 YEARS
MFMS	IB4-019		Micrometer, Depth	1/29/2001	1.00 YEARS
MFMS	IB4-020		Micrometer, Depth	1/24/2001	1.00 YEARS
MFMS	IB4-021		Caliper, Dial	3/12/2003	1.00 YEARS
MFMS	IB4-013		Micrometer, Outside Blade	3/20/2003	1.00 YEARS
MFMS	IB4-023		Height Gage, Vernier	3/12/2003	1.00 YEARS
MFMS	IB4-027		Caliper, Dial	1/25/2001	1.00 YEARS
MFMS	IB4-025		Caliper, Vernier	3/12/2003	1.00 YEARS
MFMS	IB4-028		Caliper, Dial	1/25/2001	1.00 YEARS
MFMS	IB4-059		Micrometer, Outside	1/24/2001	1.00 YEARS
MFMS	IB4-031		Square, Precision	2/7/2001	1.00 YEARS
MFMS	IB4-032		Micrometer, Depth	2/12/2001	1.00 YEARS
MFMS	IB4-033		Height Gage, Vernier	3/12/2003	1.00 YEARS
MFMS	IB4-034		Micrometer, Inside	2/12/2001	1.00 YEARS
MFMS	IB4-035		Micrometer, Inside	2/12/2001	1.00 YEARS
MFMS	IB4-036		Caliper, Vernier	3/12/2003	1.00 YEARS
MFMS	IB4-022		Caliper, Dial	3/12/2003	1.00 YEARS
MFMS	IB4-038		Square, Precision	9/28/1999	1.00 YEARS
MFMS	IB4-029		Indicator, Dial	3/18/2003	1.00 YEARS
MFMS	IB4-012		Micrometer, Outside	3/20/2003	1.00 YEARS
MFMS	IB4-045		Indicator, Dial	3/18/2003	1.00 YEARS
MFMS	IB4-044		Indicator, Dial	3/13/2003	1.00 YEARS
MFMS	IB4-043		Micrometer, Depth	1/24/2001	1.00 YEARS
MFMS	IB4-039		Indicator, Dial	9/12/2003	1.00 YEARS
MFMS	IB4-046		Height Gage, Vernier	3/12/2003	1.00 YEARS
MFMS	IB4-001		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-002		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-003		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-004		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-008		Micrometer, Outside	3/20/2003	1.00 YEARS
MFMS	IB4-006		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-011		Micrometer, Outside	3/20/2003	1.00 YEARS
MFMS	IB4-007		Micrometer, Outside	3/20/2003	1.00 YEARS
MFMS	IB4-010		Micrometer, Outside	3/20/2003	1.00 YEARS
MFMS	IB4-041		Micrometer, Inside	2/12/2001	1.00 YEARS

Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
MFMS	IB4-009		Micrometer, Outside	3/19/2003	1.00 YEARS
MFMS	IB4-005		Micrometer, Outside	3/19/2003	1.00 YEARS
MP 9	LD672381	LD672381	LCR Meter	7/10/2003	1.00 YEARS
MP 9	AB266408	AB266408	Digital Multimeter	7/10/2003	1.00 YEARS
QC (17-1)	VC123-38		Caliper, Vernier 0-36	2/14/2006	1.00 YEARS
VMS	182-208		Solid Square (L= )	12/22/1999	2.00 YEARS
VMS	182-212		Solid Square (L=13.6317 in.)	5/21/2001	3.00 YEARS
VMS	182-172		Micrometer, Depth 0-75 mm	5/6/2002	2.00 YEARS
VMS	182-221		Pin Gage Set .011-.060 inch	5/23/2005	5.00 YEARS
VMS	182-085		Height Gage, Vernier 18 inch	8/25/1998	1.00 YEARS
VMS	182-222		Pin Gage Set .061-.250 inch	5/23/2005	5.00 YEARS
VMS	182-244		Indicator, Dial 0-.030 inch	6/15/2000	1.00 YEARS
VMS	182-217		Solid Square (L=20.3869 in.)	5/10/2002	2.00 YEARS
VMS	182-159		Bore Gage 1.499 - 3.000 inch	11/11/1996	2.00 YEARS
VMS	182-140		Micrometer Set Standard 9 inch	1/12/2004	2.00 YEARS
VMS	182-088		Height Gage, Vernier 24 inch	8/28/1997	1.00 YEARS
VMS	182-073		Micrometer, Outside 1-2 inch	7/21/1998	1.00 YEARS
VMS	182-245		Indicator, Dial 0-.024 inch	8/28/2003	1.00 YEARS
VMS	182-075		Micrometer, Outside 3-4 inch	7/21/1998	1.00 YEARS
VMS	182-083		Height Gage, Vernier 12 inch	8/27/1997	1.00 YEARS
VMS	182-138		Micrometer Set Standard 7 inch	4/15/2005	2.00 YEARS
VMS	182-045		Micrometer, Outside 0-1 inch	5/4/2001	1.00 Years
VMS	182-046		Micrometer, Outside 2-3 inch	6/2/2000	1.00 YEARS
VMS	182-337		Micrometer, Outside 3-4 inch	4/23/2003	2.00 YEARS
VMS	182-335		Micrometer, Outside 1-2 inch	4/23/2003	2.00 YEARS
VMS	182-250		Gage, Dial Caliper 0.4-1.4 inch	1/7/2005	1.00 YEARS
VMS	182-276		Micrometer, Outside 0-1 inch	4/23/2003	2.00 YEARS
VMS	182-269		Micrometer, Outside 3-4 inch	8/27/2003	1.00 YEARS
VMS	182-261		Setting Standard, Micrometer	4/15/2005	2.00 YEARS
VMS	182-253		Square, Master (L= 9.0137)	9/15/2003	3.00 YEARS
VMS	182-252		Gage, Dial Caliper 1.875-2.875	1/6/2005	1.00 YEARS
VMS	182-251		Gage, Dial Caliper 1.2-2.2 inch	1/7/2005	1.00 YEARS
VMS	182-026		Micrometer, Outside 0-1 inch	5/4/2001	1.00 YEARS
WHMS	WHMS-067		Caliper, Vernier	5/19/2004	1.00 YEARS
WHMS	WHMS-069		Caliper, Dial	7/11/1996	1.00 YEARS
WHMS	WHMS-071		24" Caliper, Vernier	8/16/2004	2.00 YEARS
WHMS	WHMS-052		Micrometer, Outside	4/30/2004	2.00 YEARS

Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
WHMS	WHMS-074		Caliper, Dial 12 in.	4/11/2003	1.00 YEARS
WHMS	WHMS-1001		MICROMETER SET	4/11/2003	1.00 YEARS
WHMS	WHMS-054		Micrometer, Outside	4/30/2004	2.00 YEARS
WHMS	WHMS-009		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-008		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-007		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-006		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-005		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-004		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-003		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-001		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-011		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-1011		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-012		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-1010		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-1009		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-1008		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-1007		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-1006		Setting Standard, Micrometer	8/16/2004	2.00 YEARS
WHMS	WHMS-1005		Setting Standard, Micrometer	4/11/2003	1.00 YEARS
WHMS	WHMS-1004		Setting Standard, Micrometer	4/11/2003	1.00 YEARS
WHMS	WHMS-1003		Setting Standard, Micrometer	4/11/2003	1.00 YEARS
WHMS	WHMS-1002		Setting Standard, Micrometer	9/19/1997	1.00 YEARS
WHMS	WHMS-1023		Micrometer, outside	8/19/2003	1.00 YEARS
WHMS	WHMS-049		Micrometer, Outside	4/16/2004	2.00 YEARS
WHMS	WHMS-066		Caliper, Vernier	4/29/2004	2.00 YEARS
WHMS	WHMS-065		Caliper, Dial	8/16/2004	2.00 YEARS
WHMS	WHMS-064		Caliper, Vernier	4/29/2004	2.00 YEARS
WHMS	WHMS-063		Caliper, Vernier	6/2/1997	2.00 YEARS
WHMS	WHMS-062		Caliper, Vernier	4/29/2004	2.00 YEARS
WHMS	WHMS-061		Caliper, Vernier	4/29/2004	2.00 YEARS
WHMS	WHMS-058		Micrometer, Inside	8/16/2004	2.00 YEARS
WHMS	WHMS-055		Micrometer, Outside	4/30/2004	2.00 YEARS
WHMS	WHMS-053		Micrometer, Outside	4/30/2004	2.00 YEARS
WHMS	WHMS-010		Micrometer, Outside	5/16/2005	2.00 YEARS
WHMS	WHMS-050		Micrometer, Outside	4/16/2004	2.00 YEARS
WHMS	182-306		Micrometer, Groove 0-1 inch	5/16/2005	2.00 YEARS

Storage Location	Gage ID	Gage S/N	Description	Due Date	Frequency
WHMS	WHMS-048		Micrometer, Outside	5/12/2004	1.00 YEARS
WHMS	WHMS-047		Micrometer, Outside	5/12/2004	1.00 YEARS
WHMS	WHMS-046		Micrometer, Outside	5/12/2004	1.00 YEARS
WHMS	WHMS-045		Micrometer, Outside	4/30/2004	2.00 YEARS
WHMS	WHMS-029		V-ANVIL MICROMETER	5/19/2004	1.00 YEARS
WHMS	WHMS-028		Micrometer, Outside	4/5/1996	1.00 YEARS
WHMS	WHMS-016		Micrometer, Outside	11/9/1998	1.00 YEARS
WHMS	WHMS-015		Micrometer, Outside	9/26/1996	1.00 YEARS
WHMS	WHMS-014		Caliper, Dial	5/19/2004	1.00 YEARS
WHMS	WHMS-051		Micrometer, Inside 1-2 in.	1/10/2005	1.00 YEARS

227 Records Printed